SYNOPSIS OF PROPOSED RESEARCH

FOR

DOCTORAL DEGREE IN FOOD PROCESSING AND NUTRITION

Title of the research work

"Effect of white finger millet flour *(Eleucine coracana)* on Rheological, Physico, Sensory, Nutritional and Quality characteristics of composite bread"

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CHAPTER-I

INTRODUCTION

India is the world's second largest producer of food next to China, and has the potential of being the biggest with its food and agricultural sector. The Indian bakery industry is one of the biggest sections in the country's processed food industry. Bakery products, which include bread and biscuits, form the major baked foods accounting for over 82 per cent of the total bakery products produced in the country. It enjoys a comparative advantage in manufacturing, with an abundant supply of primary ingredients required by the industry, and is the third-largest biscuit manufacturing country (after the United States and China). The bakery segment in India can be classified into the three broad segments of bread, biscuits and cakes. India's organized bakery sector produces about 1.3 millions tone of bakery products (out of three million tons) while the balance is produced by unorganized, small-scale local manufacturers.

BAKERY PRODUCTS

Bakery products, due to high nutrient value and affordability, are an item of huge consumption. Due to the rapid population rise, the rising foreign influence, the emergence of a female working population and the fluctuating eating habits of people, they have gained popularity among people, contributing significantly to the growth trajectory of the bakery industry. Bakery holds an important place in food processing industry and is a traditional activity. With regard to bakery products, consumers are demanding newer options, and the industry has been experiencing fortification of bakery products in order to satiate the burgeoning appetite of the health-conscious Indian. A number of healthy products have been launched in the bakery segment, and are gaining popularity at a high rate. The mounting presence of bakery chains has further triggered the growth in the sector.

Bakery products are an item of mass consumption in view of their low price and with rapid growth and changing eating habits of people; bakery products have gained popularity among masses. Trends in baking continue toward lighter, healthier products, and those containing allergen-free, organic, and whole-grain ingredients. Interest in inclusions and fortification continues to increase among consumers of baked goods. They include fibre, antioxidants, omega-3 oils, and vitamin and mineral fortifications. The addition of inclusions to baked products requires modifications to the original product formula, thus creating a new product

from an existing one. Such modifications can be challenging to bakers as changes in formulation may result in the need for changes to equipment, processes and ingredient costs. The use of whole and alternative grains and grain products continues to drive new product development. In response to the demand for products that are free from gluten and other allergens, baked goods using flours made from buckwheat, quinoa, millet, amaranth, flax, corn, rice, sorghum, wild rice, and other non-wheat grains remain a popular trend in baking. These flours offer tastes and textures that are uniquely different from wheat flours, which also serve the trend toward more types of artisan and handcrafted breads.

Functional food in baking industry

Functional foods are gaining popularity worldwide in dietary modifications owing to consumer's preference, minimum side effect and low cost. Application of functional food in baking industry is one of the prime steps to cope the various physiological threats. It has been focused to introduce several bioactive chemical compounds in bread development. Utilization of the bioactive moieties in bread making process to not only improves dough handling properties, freshness, shelf life but main target is to combat various ailments.

Finger millet flour for the bakery industry

Finger millet (*Eleusine coracana*) is also known as ragi, mandua (major crop of Uttarakhand) nagli and nachani and is widely grown on hilly areas and southern part of India. It is a staple crop of eastern and central Africa and is also popular in certain part India. Among all cereals calcium content is higher in ragi as well as iodine content is also rich in Ragi among all food grains. It is rich in protein, vitamin, fiber; iron, calcium, phosphorus and all essential amino acid are found. So it is a good source of diet for growing children, women and old age people. It is consumed in the form of roti, pudding, porridge and preparation of flour. Ragi is easily digestible as it contains higher level of antioxidants, phytochemical and calcium. That is why they act as Nutraceutical.

With the change in scenario of utilization of processed products and awareness of the consumers about the health benefits, finger millet has gained importance because of its functional components such as slowly digestible starch and resistant starch. The composite flour of ragi and wheat appears not only to improve the nutritional quality but promote the health benefits. Ragi is a crop that can withstand severe drought conditions and can be easily grown throughout the year. Nutritionally, when ragi is used as a whole grain, it is higher in

protein and minerals in comparison with all other cereals and millets. It is a remarkable source of protein, making it perfect for vegetarian diets.

In view of the trends in diversification of bakery products and important of health bakery products composite bread containing millets such as Ragi has great scope. It is not only gives touch of the local taste but also contribute to the variety as well as nutrition, Ragi is particularly rich in calcium, contributes greater percentage of dietary fibre and it is specially advised as a food for patients suffering from diabetes and cardiovascular diseases. All these factors as well as the cheaper cost of Ragi, compared to wheat, contribute to greater opportunity value of composite Ragi bread.

Bread is a very popular baked product liked by all, especially children and working class, both in rural and urban areas. However, ragi bread has greater potential because of its better nutritional value due to high content of calcium, palatability, touch of familiar taste above all variety and better affordability by the consumers at large.

White ragi flour for the bakery industry

Finger millet being one of the most nutritious and drought hardy crop demand for it is expected to increase in future. Although its consumption is in inevitable for people suffering from diabetic the dark colour of grains has been the major hindrance for its acceptability. In this preview an investigation was taken to develop a white grained finger millet variety for value addition especially for the bakery industry. The purpose of the study is to formulate and develop functional breads from wheat flours composited with white ragi flour

NEED FOR THE STUDY

The demand for finger millet has increased due to its health benefits. Traditionally, it is consumed in variety of forms, such as unleavened bread (roti), mudde, thin or thick porridge, and fermented porridge, and also used in brewing. However, the dark colour of grains has been the major hindrance for its acceptability by children. In this preview a thought on white finger millet has arisen. Among both brown and white grain types, white grain types are preferred because of their high protein, low fibre, low tannins and higher consumer acceptability. Thus, demand for white grained finger millet has picked up in the baking industry. With this background, an investigation is taken to develop a white grained finger millet variety for value addition especially for the bakery industry.

1.1. STATEMENT OF THE PROBLEM

The purpose of the study was to formulate and develop functional breads from whole wheat flours composited with white ragi flour as composite flour of ragi and wheat appears not only to improve the nutritional quality but promote the health benefits

1.2. HYPOTHESIS OF THE STUDY

a. The existing bread needs improvement in terms of nutritional value
b. It is possible to develop a new product with nutritional value and health benefits
c. The newly developed functional bread brings a positive feedback on Nutraceutical aspects.
d. There is a positive effect of the product as it is good source of diet for growing children, women and old age people.

1.3. SIGNIFICANCE OF THE STUDY

a. This study is helpful to develop functional bread with white grained finger millet variety for value addition especially for the bakery industry.
b. This study throws light on the importance of introducing white grained finger millet variety (KMR 340).
c. This study urges the awareness of the importance of finger millet because of its functional components such as slowly digestible starch and resistant starch and rich source of protein, vitamin, fiber; iron, calcium, phosphorus and all essential amino acid are found.
d. This study brings desirable attitudes among baking industry towards giving preference to white grained finger millet based bakery products.
e. This study helps to create a sense of interest to the researchers in various institutions to formulate gluten free, low glycemic index based bakery products.

OBJECTIVES OF THE STUDY

1. To study the nutritional value of the wheat flours and white ragi flour used in the formulation.
2. Standardization and formulation of Nutraceutical based millets products. (To formulate and develop functional breads from whole wheat flours composited with white ragi flour).

3. To optimize the whole wheat bread with different levels of white ragi flour in order to access the acceptable levels of white ragi flour in bread formulations.

4. To evaluate for its physical properties viz. loaf weight, loaf volume, specific loaf volume, Colour, Crumb firmness

5. To evaluate the nutritional composition such as carbohydrate, protein, fat, crude fiber, ash, calcium etc.

6. To study the textural properties of the formulated products

7. To analyze the Sensory quality attributes -Colour and appearance, Texture and grain, Flavor, Crispiness, Taste and Overall acceptability.

8. To study the micro structural characteristics in order to study the interactions of the compositions

9. Storage study for the best accepted products

1.4. LIMITATIONS

1. The product could have a limited shelf as it has nutrition rich with high moisture content
2. The product requires gluten proteins and it is impossible to formulate the functional bread without replacing the wheat flour.

1.5. DELIMITATIONS

1. This study is restricted to celiac disease patients as it contains wheat proteins along with white grain finger millet flour.
2. This study is restricted to white grained finger millet variety (KMR 340).
3. This study is restricted only to bread as Bread is a very popular baked product liked by all, especially children and working class, old age group both in rural and urban areas.
4. This study is restricted to baked products as it is used as a substitute for refined wheat flour.

1.6 DEFINITION AND EXPLANATION OF TERMS

1. Functional foods- functional foods are foods that provide both health benefits to reduce the risk of chronic diseases and basic nutrition. Functional foods may be defined as any food that has a positive impact on an individual's health, physical performance, or state of mind, in addition to its nutritious value.

2. Composite flours- are a mixture of flours from tubers rich in starch (e.g. cassava, yam, sweet potato) and/or protein rich flours (e.g. soy, peanut) and /or cereals (e.g. maize, rice, millet, buckwheat), with or without wheat flour.

3. Food fortification or enrichment is the process of adding micronutrient (essential trace elements and vitamins) to food. It can be carried out by food manufacturers or by governments as a public health policy which aims to reduce the number of people with dietary deficiencies within a population.

4. Nutraceutical -"Nutraceutical" is a substance that may be considered a food or part of a food which provides medical or health benefits, encompassing prevention and treatment of disease. Products as diverse as isolated nutrients, dietary supplements and diets to genetically engineered "designer" foods, herbal products, and processed foods (cereals, soups, beverages) may be included under the umbrella of Nutraceutical. In India, Nutraceutical have been defined under Clause 22 of the Food Safety and Standards Act (FSSA), 2006. This chapter describes the role of Nutraceutical in health and how they are different from functional foods and dietary supplements. Examples of Nutraceutical are natural foods including antioxidants, dietary supplements, fortified dairy products, and citrus fruits, and vitamins, minerals, herbals, milk, and cereals.

5. White grained finger millet (KMR 340)- White ragi variety, specially for confectionary purpose, resistant to blast and blight diseases, tolerant to stem borer and aphids

CHAPTER II

REVIEW OF RELATED LITERATURE

White flour is obtained from wheat kernel by removing bran and germ and only extracting the starchy endosperm. Starchy endosperm is white in color therefore, flour obtained is known as white flour/refined flour and the bread prepared from that is known as white bread. White flour is rich source of carbohydrate, protein and physiological energy but on the contrary poor source of fiber, vitamins, minerals and quality protein due to removal of bran and germ of the outer seed coat. Thus, the white flour is nutritionally poor and it must be enriched with the fiber, vitamins and minerals to overcome the malnutrition problem which is spread worldwide.

Millets are small seeded grains used for food, feed and forage. They are widely cultivated in the tropics and consumed by all age groups in several forms. With respect to other cereals, millets are nutritionally comparable and even superior to some major cereals **(Anonymous 2009; Gopalan *et al.* 2010; Balasubramanian *et al.* 2007).**

Finger Millet (*Eleusine coracana, Ragi)* is a type of small millets. It is rich in protein, iron, calcium, phosphorus, fibre and vitamin content. The calcium content is higher than that of the all cereals.

Ragi was a major source of dietary carbohydrates for a large section of society. Ragi has various health benefits and is a good source of micro-nutrients. Value added food products based on ragi, is the need for wellbeing of society as it enriches the nutritional value and is beneficial for good health. Today the foods are not meant for taste and delight of eating but also for their high nutritional quality and health benefits.

Gopalan *et al.*, (1987) suggested that finger Millet has best quality protein along with the presence of essential amino acids, vitamin A, vitamin B and phosphorus.

Finger Millet can be a good source of diet for growing children, women, old age people and patients. The bakery sector is also focusing on the use of minor millets as a source of dietary fiber and bioactive compounds **(Hugo *et al.*, 2009; Singh *et al.*, 2012; Ballolli *et al.*, 2014; Bhol and John Don Bosco 2014).**

Consumption of bakery product in international food market is at very high rate **(Jideani and Onwubali, 2009)**. Baking industry covers major area among food processing industry **(**Wojtowicz et al 2013**;** Abd-El-Haleem SHM et al 1998**)**. Easy availability, good shelf life and ready to eat convenience make baked good popular among people **(Saleh ASM Zhang *et al*., 2013)**.

Scientifically Bread is "soft and, like many other foodstuffs, is comprised, at a macroscopic level, of two phases- a fluid (air) and a solid (cell wall material)" (**Clark 1991; Scanlon *et al*., 1995).**

Millets are minor cereals of grass family Poacae. Finger Millets (*Eleusine coracana*) have various nutritional qualities, and have rightly been called nutri-cereals". Wheat is traditionally used in breads, and consumption of millet can be increased by replacing wheat by millet to a required extent. The Millet kernel constitutes 15% of seed coat and is a good source of calcium, dietary fiber and polyphenols. **(Chetan and Malleshi, 2007).**

Meroth et al (2004) stated that Millets are rich in proteins, especially in essential amino acids such as lysine, which is limited in wheat and rye flour.

Shobana and Malleshi (2007) reported that the major health benefits associated with regular intake of millet foods are hypocholesterolemic, hypoglycemic and antiulcerative which indicate the scope for its utilization by the non-traditional millet consumer also.

Devi *et al.*, (2014) reviewed that health benefits of finger millets are attributed to its polyphenol and dietary fiber contents. It is an important staple food in India for people of low income groups. Nutritionally, its importance is well recognized because of its high content of calcium (0.38%), dietary fiber (18%) and phenolic compounds (0.3–3%). They are also recognized for their health beneficial effects, such as antidiabetic, anti-tumerogenic, atherosclerogenic effects, antioxidant and antimicrobial properties.

Desai *et al.*, (2010) reported that lots of varieties of foods are prepared from ragi which varies from country to country and also from region to region within a country, such as thin or thick porridge , unleavened bread, fermented porridge, making "ingera", etc.

Ndife and Abbo, (2009) emphasized that awareness of the need to eat high quality and healthy foods – known as functional foods, is increasing among consumers. These foods contain ingredients that provide additional health benefits beyond the basic nutritional requirements.

Gallagher *et al.*, (2003) studied the use of alternative flours in baked products and suggested that the use of such alternative flours is restricted due to their low baking quality, as well as the sensory quality of the baked products.

Verma and Patel (2013) studied the development of composite bread using the ragi flour and quantized that the development of new food products is a modern trend and it provides nutritional security as well. The results showed that the composite bread prepared by using ragi flour was found to have high calcium, soluble dietary fiber, tannin and phytic acid. Instead, the control bread contained significantly higher carbohydrate, physiological energy and starch.

Dewettinck *et al.*, (2008) reported that Bread is a food consumed all over the world by all age people. It is prepared from white flour, yeast, sugar, fat, salt, water, etc., by a series of operations like mixing, kneading, fermentation, proofing and baking.

Gull *et al.*, (2016) studied about Wheat-Finger Millet composite flour and reported that with the changing perception toward health and taste, people are demanding functional food, composite flour food which provides the health benefits as well as appealing sensory characteristics. Wheat-Finger Millet composite flour can be converted into variety of new food products such as noodles, vermicelli, pasta products, papads, roller dried finger millet-based soup mixes, bakery products such as bread and biscuits.

Lakshmi *et al.*, (2002) suggested that dietary fibre is the contributing factor for its low glycemic index and thus it is useful to control blood glucose levels in diabetic patients very efficiently and considered to be ideal food for diabetic individuals due to its low sugar content and slow release of glucose/sugar in the body.

Studies showed that millets have good nutrition qualities, and are known as “nutri-cereals”. Wheat was traditionally used in breads, and millets consumption can be increased if it is being incorporated in wheat flour at certain acceptable levels in breads.

The present study is undertaken to evaluate possibility of increasing the nutritional quality of bread by incorporating Finger Millet flour and its effect on quality of bread

CHAPTER III

METHODOLOGY

In this chapter, the selection of the samples, selection of the tools of the measurement and the technique used for analysing the data are discussed.

METHODOLOGY

The present study follows the Analytical method.

2. MATERIALS AND METHODS

2.1 Selection of samples

For this study, white grained ragi variety (KMR 340 finger millet variety) was collected from the ZARS Mandya, and the basic raw materials were procured from the local market.

2.2 Preparation of ragi flour

Grains were thoroughly cleaned and made free from dust and other foreign materials. Germinated grains were dried in a dryer at 55°C for 24 h. They were then milled in a lab scale centrifugal flour mill and the ragi flour was stored in deep freezer at temperature for further analysis and incorporation into composite flour to prepare breads.

2.3 Formulation and preparation of bread

The common procedure used for preparation of bread using straight dough method

2.4 Final Product Testing

For the final product testing parameters to be tested are moisture, protein, fat, ash and loaf volume. The loaf volume was measured by rape seed displacement method. The other parameters that are moisture, protein, ash and fat are tested by methods approved by AOAC.

2.4.1Moisture content

Moisture content of fortified bread was found by weighing 5g sample accurately and subjecting it at 105°C temperature for 4-6 hrs. Oven dried samples were cooled in desiccators and weighed. The resultant loss in weight was calculated as percent moisture content.

2.4.2 Crude Fat

Crude fat was determined by taking 5 g bread sample in thimble and defatted with n-hexane (boiling point 68-720C) in soxhlet apparatus for 8hrs. The resultant extract was evaporated and crude fat content was calculated as per AOAC.

2.4.3 Crude protein

Protein was estimated by Microkjaldhel method using 0.5g of moisture free defatted bread by digesting with concentrated sulphuric acid at 130-140˚C. Then it was distilled with 40 per cent sodium hydroxide and liberated ammonia was trapped in 4 per cent boric acid, using mixed indicator (methyl red : Bromo-ceresol green 1: 5). It was then titrated with 0.1N hydrochloric acid; the percentage nitrogen was estimated. The protein percent was calculated by multiplying percent nitrogen with 6.25 (AOAC)

2.4.5 Crude Fiber

Crude fibre was determined according to AOAC. 2 g fat free bread residue was taken and digested with 200 ml boiling sulphuric acid for 30 min. Then it was filtered and washed with hot water or potassium sulphate solution. The residue was returned to digestion flask by washing with hot water, 200 ml boiling sodium hydroxide was added and boiled for 30 min and filtered. The residue was transferred into crucible and washed with 15 ml alcohol and kept for drying at 110℃ for 2 hrs. The crucible was cooled in desiccators and weighed. The crucible was ignited in the furnace at 550℃ for 30 min. then cooled and weighed. The loss in weight represented the crude fibre.

2.4.6 Total ash

Total ash was determined according AOAC. Sample (5g) was weighed into a crucible and burnt completely at low flame till all the material became smokeless. Then it was kept in muffle furnace for 6 hrs at 600℃, cooled in desiccators and weighed. The sample was again put in muffle furnace at 550℃ till two consecutive weights were constant and per cent ash was calculated.

2.4.7 Total carbohydrate

Total carbohydrate of bread was determined by standard procedure using phenol and sulphuric acid AOAC (1990). Sample (500 mg) was mixed with 2 ml of 72 per cent H_2SO_4. Then the volume of solution was made to 23 ml with distilled water. The sample was refluxed in water bath at 90 + 5°C for 3 hr. The standard curves was prepared using standard glucose solution corresponding to 0.2, 0.4, 0.6, 0.8 and 1 □g of glucose. The intensity of colour was measured at 480 nm by spectrophotometers. From the standard curve, the concentration of total sugar was calculated.

2.4.8 Iron, Magnesium, Calcium

They were determined by AAS method following AOAC (2007).

2.4.9 Phosphorus

Phosphorus is determined by Colorimetric method at 660 nm following the procedure described in AOAC (2007)

2.5 Texture Profile Analysis

Texture Analyzer was used for texture profile analysis (TPA) of fortified bread prepared at different levels of wheat flour and ragi flour. The crumb firmness was the major parameter found using texture profile analysis.

2.6 Color measurement

The color of the bread is measured using Hunter color lab. The sample is kept in the transparent tile and the reading has taken for the L, a and b values. The color values L (light-dark), a (red-green), and b(yellow-blue) of the bread and crumb samples.

2.7 Sensory evaluation of fortified bread

Freshly prepared bread was evaluated for sensory characteristics color, flavor, taste, texture and overall acceptability at room temperature in sensory evaluation laboratory by semi trained 50 judges, comprised of college department and academic staff members of the faculty on 9-point Hedonic Scale.

2.8 Scanning electron microscopic studies

SEM studies were carried out using scanning electron microscope according to the method of Prabhasankar, Indrani, Jyotsna, and Venkateswara Rao (2003). Samples (size 20X 20 mm) were defatted with hexane, followed by freeze-drying. The freeze-dried samples were kept in a desiccator until further use. Samples were separately placed on the sample holder with the help of a double sided scotch tape and sputter-coated with gold (2 min, 2 mbar). Finally, each sample was transferred to the microscope where it was observed at 15 kV and 9.75_10_5 torr vacuum.

2.8 Shelf life / storage studies

Based on moisture and texture analysis during storage period of time after subsequent interval

3. Statistical analysis

The analysis of variance of the data obtained was done by using Completely Randomized Design (CRD) for different treatments as per the methods given by Panse and Sukhatme

(1985). The analysis of variance revealed at significance of $P< 0.05$ level, S.E. and C.D. at 5 % level is mentioned wherever required.

4. Results and Discussion

The present investigation was conducted with the objective to study the effect of addition white grained ragi flour on physical, nutritional, textural and sensory characteristics of bread. The study was focused on standardizing the concentration of composite flour in bread to a level of acceptable quality.

CHAPTER IV

REFERENCE

Abd-El-Haleem SHM, Reham MA, Mohamed SMS, Abdel-Aal ESM, Sosulski FW, Hucl P. Origins, characteristics and potentials of ancient wheat's. Cereal Foods World. 1998; 43:708-715.

A.O.A.C (2005) Official Methods of Analysis of the AOAC International, 18th ed. Association of Official Analytical Chemists, Gaithersburg, MD.

Anonymous, 2009. Millet Network of India. Deccan Development Society, FIAN, India.

Balasubramanian, S., Vishwanathan, R. and Sharma, R. 2007. Post harvest processing of millets: An appraisal. *Agriculture Engineering Today* 31(2): 18–23.

Ballolli, U., Malagi, U., Yenagi, N., Orsat, V. and Gariepy, Y. 2014. Development and quality evaluation of foxtail millet [*Setariaitalica* (L.)] incorporated breads. *Journal of Agricultural Science* 27(1): 52–54.

Bhol, S. and John Don Bosco, S. 2014. Influence of malted finger millet and red kidney bean flour on quality characteristics of developed bread. *LWT- Food Science and Technology* 55(1): 294–300.

Chethan S., Malleshi N.G. (2007): Finger millet polyphenols: Characterization and their nutraceutical potential. American Journal of Food Technology, 2: 582–592.

Clark A.H. (1991) Structural and mechanical properties of biopolymer gels. *Royal Society of Chemistry*, Cambridge pp. 322–338.

Devi P.B., Vijayabharathi R., Sathyabama S., Malleshi N.G., Priyadarisini V.B. (2014): Health benefits of finger millet (Eleusine coracana L.) polyphenols and dietary fibre: a review. Journal of Food Science and Technology, 51: 1021–1040.

Desai, A. D., Kulkarni, S. S., Sahu, A. K., Ranveer, R. C. and Dandge, P. B., "Effect of supplementation of malted Ragi flour on the nutritional and sensorial quality characteristics of cake*". Adv. J. Food Sci. Tech.,* 2(1): 67-71 (2010).

Dewettinck, K., Van Bockstaele, F., Kuhne, B., Van de Walle, D., Courtens, T.M. and Gellynck, X. 2008. Nutritional value of bread: Influence of processing, food interaction and consumer perception. *Journal of Cereal Science* 48: 243-257.

Gallagher. E, Gormley T.R, Arendt E. K. 2003. Crust and crumb characteristics of gluten-free breads, *Journal of Food Engineering*, 56 : 153-161

Gopalan, C., Rama Sastri, B.V. and Balasubramanian, S.C. 1987. Nutritive value of Indian foods. National Institute of Nutrition, Indian Council of Medical Research. Hyderabad, India.

Gopalan, C., Ramasastri, B.V. and Balaubramanian, S.C. 2010. Nutritive value of Indian foods. National Institute of Nutrition, ICMR, Hyderabad.

Gull Amir, Gulzar Ahmad, N., Kamlesh Prasad and Pradyuman Kumar. 2016. Technological, Processing and Nutritional approach of Finger Millet (*Eleusine coracana*) - A Mini Review. *Journal of Food Processing & Technology* **7**(6): 593.

Hugo, L.F., Rooney, L.W. and Taylor, J.R.N. 2009. Bread making with malted and fermented sorghum. [2009–06- 17].

Jideani V, Onwubali F. Optimisation of wheat-sprouted soybean flour bread using response surface methodology. *Afr. J. Biotechnol*. 2009; 8(22):6364-6373.

Lakshmi, K.P. and Sumathi, S. 2002. Effect of consumption of Finger Millet on hyperglycemia in non-insulin dependent diabetes mellitus (NIDDM) subjects. *Food and Nutrition Bulletin* **23**(3)**:** 241-245.

Meroth CB, Hammes WP, Hertel C (2004) Characterisation of the microbiota of rice sourdoughs and description of Lactobacillus spicheri species. *Systematic and Applied Microbiology* 27: 151-159.

Ndife J, Abbo E. Functional Foods: Prospects and Challenges in Nigeria. J Sci. Technol. 2009; 1(5):1-6.

Panse G.V. and Sukhatme P.V. (1985) Statistical Method for Agricultural Workers. ICAR, New Delhi.

Prabhasankar, P., Indrani, D., Jyotsna, Rajiv, & Venkateswara Rao. (2003). Scanning electron microscopic studies – baking process of parotta. Food Chemistry, 82, 603–609.

Singh, K.P., Mishra, A., & Mishra, H. N. 2012. Fuzzy analysis of sensory attributes of bread prepared from millet-based composite flours. *LWT- Food Science and Technology* 48 (2):276–282.

Saleh ASM Zhang Q, Chen J, Shen Q. Millet Grains Nutritional Quality, Processing, and Potential Health Benefits. Comprehensive Reviews in Food Science and Food Safety. 2013; 12:281-295.

Scanlon M.G., Sapirstein H.D and Fahloul D (1995) *Journal of Cereal Science*, 32 x pp. 235–243.

Veenu Verma and S. Patel. (2013). Value added products from nutri-cereals: Finger millet (Eleusine coracana), *Emir. J. Food Agric*. 2013. 25 (3): 169-176

Wojtowicz A, Kolasa A, Moscicki L. Influence of buckwheat addition on physical properties, texture and sensory characteristics of extruded corn snacks, Polish Journal of Food and Nutrition Sciences. 2013; 63(4):239-244.